

TITLE: *A Grobner Basis Solution for Lightning Ground Flash Fraction Retrieval*

Dr. Richard Solakiewicz, Department of Mathematics & Computer Science, Chicago State University, 9501 South King Drive, Chicago, IL 60628. *Email address:* rsolakie@csu.edu.

Dr. Rohan Attele, Department of Mathematics & Computer Science, Chicago State University, 9501 South King Drive, Chicago, IL 60628. *Email address:* R-Attele@csu.edu.

Dr. William Koshak, Earth Science Office, VP61, NASA Marshall Space Flight Center, Robert Cramer Research Hall, 320 Sparkman Drive, Huntsville, AL 35805. *Email address:* william.koshak@nasa.gov.

Abstract.

A Bayesian inversion method was previously introduced for retrieving the fraction of ground flashes in a set of flashes observed from a (low earth orbiting or geostationary) satellite lightning imager. The method employed a constrained mixed exponential distribution model to describe the lightning optical measurements. To obtain the optimum model parameters, a scalar function was minimized by a numerical method. In order to improve this optimization, we introduce a Grobner basis solution to obtain analytic representations of the model parameters that serve as a refined initialization scheme to the numerical optimization. Using the Grobner basis, we show that there are exactly 2 solutions involving the first 3 moments of the (exponentially distributed) data. When the mean of the ground flash optical characteristic (e.g., such as the Maximum Group Area, MGA) is larger than that for cloud flashes, then a unique solution can be obtained.